

BICYCLIC IMIDAZO-5-YL-AMINE DERIVATIVES

## CROSS REFERENCE TO RELATED APPLICATIONS

**[0001]** The present application is a continuation of international patent application no. PCT/EP00/09097, filed September 18, 2000, designating the United States of America, the entire disclosure of which is incorporated herein by reference. Priority is claimed based on Federal Republic of Germany patent application nos. 199 48 436.8, and 199 48 434.1, both filed October 8, 1999.

## BACKGROUND OF THE INVENTION

**[0002]** The present invention relates to substituted bicyclic imidazo-5-yl- amines and medicaments comprising these compounds.

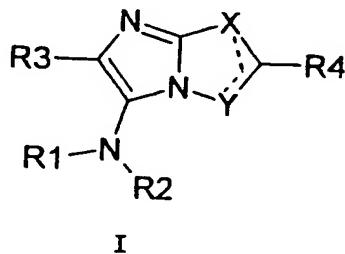
**[0003]** Individual representatives from the class of bicyclic imidazo-5-yl- amines are described in EP-A-0 518 033. These compounds carry aromatic substituents bonded via a short alkyl bridge on the imidazole nitrogen which does not belong to the fused ring system. The compounds described in EP-A-0 518 033 as potent angiotensin antagonists which can be employed in medicaments for treatment of circulatory diseases such as high blood pressure.

**[0004]** Attempts have subsequently been made also to prepare those bicyclic imidazo-5-yl-amines which are not substituted on the imidazole nitrogen which does not belong to the fused ring system. However, these attempts had no (K. Groebke et al., *Synlett* 1998, 661) or only little success (H. Bienayme, K. Bouzid, *Angew. Chem.* 1998, 110 (16), 2349).

**[0005]** The present invention was therefore based on the object of providing bicyclic imidazo-5-yl-amines which are not substituted on the imidazole nitrogen which does not belong to the fused ring system, and medicaments comprising these compounds.

## SUMMARY AND DETAILED DESCRIPTION OF THE INVENTION

**[0006]** The invention therefore provides bicyclic imidazo-5-yl-amines of the general formula I



wherein

$R^1$  denotes  $C(CH_3)_3$ ,  $(CH_2)_6CN$ , optionally substituted phenyl,  $C_4-C_8$ -cycloalkyl,  $CH_2CH_2R$  ( $R = 4$ -morpholino), 1,1,3,3-tetramethylbutyl or  $CH_2R^a$ , wherein  $R^a$  represents hydrogen,  $C_1-C_8$ -alkyl (branched or unbranched), optionally substituted phenyl,  $CO(OR')$  (where  $R' = C_1-C_8$ -alkyl (branched or unbranched)),  $PO(OR'')_2$  (where  $R'' = C_1-C_4$ -alkyl (branched or unbranched)) or  $Si(R^xR^yR^z)$  (where  $R^x$ ,  $R^y$  and  $R^z$  in each case independently of one another are  $C_1-C_8$ -alkyl (branched or unbranched),  $C_4-C_8$ -cycloalkyl or phenyl),

$R^2$  denotes hydrogen;  $COR^b$ , wherein  $R^b$  represents hydrogen,  $C_1-C_8$ -alkyl (branched or unbranched),  $C_3-C_8$ -cycloalkyl,  $CH_2CH_2CO(OR')$  (where  $R' = C_1-C_8$ -alkyl (branched or unbranched)), adamantyl, optionally substituted phenyl, optionally substituted 1-naphthyl, 2-naphthyl, 2-pyridyl, 3-pyridyl, 4-pyridyl, thiazolyl or furoyl,  $CH_2R^c$ , wherein  $R^c$  represents hydrogen,  $C_1-C_8$ -alkyl (branched or unbranched) or optionally substituted phenyl;  $CH_2CH_2R^d$ , wherein  $R^d$  represents optionally substituted phenyl; or  $CONHR^e$ , wherein  $R^e$  represents phenyl,

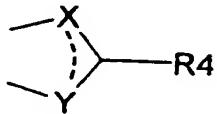
$R^3$  denotes  $C_1-C_8$ -alkyl (branched or unbranched),  $C_3-C_8$ -cycloalkyl, optionally substituted phenyl, optionally substituted 1-naphthyl, 2-naphthyl, quinoline, anthracene, phenanthrene, benzothiophene, benzofurfuryl, optionally substituted

pyrrole, 2-pyridyl, 3-pyridyl, 4-pyridyl, optionally substituted furfuryl or optionally substituted thiophene,

X denotes CR<sup>5</sup>, N or S, and

Y, in the case where X denotes S, denotes CR<sup>6</sup> or N, and in all other cases denotes N,

wherein the broken line in the structural element



means that in the cases where X denotes S, Y is linked via a double bond with the C atom carrying R<sup>4</sup>, and in all other cases one of the groups X or Y is linked via a double bond with the C atom carrying R<sup>4</sup> and the other particular group carries an additional hydrogen,

R<sup>4</sup>, R<sup>5</sup> and R<sup>6</sup> independently of one another denote hydrogen, C<sub>1</sub>-C<sub>8</sub>-alkyl (branched or unbranched); fluorine; chlorine; bromine; CF<sub>3</sub>; CN; NO<sub>2</sub>, NHR<sup>f</sup>, wherein R<sup>f</sup> represents hydrogen, C<sub>1</sub>-C<sub>8</sub>-alkyl (branched or unbranched) or optionally substituted phenyl; SR<sup>g</sup>, wherein R<sup>g</sup> represents hydrogen, C<sub>1</sub>-C<sub>8</sub>-alkyl (branched or unbranched), phenyl, pyridine, benzyl or fluorenyl; OR<sup>h</sup>, wherein R<sup>h</sup> represents C<sub>1</sub>-C<sub>8</sub>-alkyl (branched or unbranched), optionally substituted phenyl or CO(OR') (R' = C<sub>1</sub>-C<sub>8</sub>-alkyl (branched or unbranched)); CO(OR') or CH<sub>2</sub>CO(OR'), wherein R' in each case has the abovementioned meaning or in the case of the group CH<sub>2</sub>CO(OR') also denotes hydrogen, or an optionally substituted phenyl group; and pharmaceutically acceptable salts thereof,

excluding compounds in which either at the same time R<sup>1</sup> denotes C(CH<sub>3</sub>)<sub>3</sub>, R<sup>2</sup> denotes hydrogen, R<sup>3</sup> denotes unsubstituted phenyl, X denotes S and Y denotes

N or CR<sup>6</sup>, where R<sup>6</sup> = hydrogen or CH<sub>2</sub>-CO<sub>2</sub>-ethyl, or at the same time R<sup>1</sup> denotes C(CH<sub>3</sub>)<sub>3</sub>, R<sup>2</sup> denotes hydrogen, R<sup>3</sup> denotes unsubstituted phenyl, Y denotes NH and X denotes N or CR<sup>5</sup>, where R<sup>5</sup> = CO<sub>2</sub>ethyl.

**[0007]** Optionally substituted phenyl, optionally substituted 1-naphthyl, optionally substituted pyrrole, optionally substituted furfuryl, optionally substituted thiophene, optionally substituted isocyanate and optionally substituted alkyl, according to the instant invention, may be optionally substituted by one or more substituents selected from the group consisting of a halogen atom, cyano group, nitro group, carboxyl group, hydroxyl group, C<sub>1</sub>-C<sub>4</sub> alkylamido group, C<sub>1</sub>-C<sub>4</sub> alkylamino group, pyrrolidino group, branched or unbranched C<sub>1</sub>-C<sub>6</sub> alkyl group, C<sub>1</sub>-C<sub>4</sub> alkyl group substituted with one or more halogen atoms, C<sub>1</sub>-C<sub>4</sub> alkoxy group, C<sub>1</sub>-C<sub>4</sub> alkoxy group substituted with one or more halogen atoms, and halogen substituted phenoxy group.

**[0008]** Where R<sup>3</sup> is a substituted phenyl group, it is preferably 4-acetamidophenyl, 2-bromophenyl, 3-bromophenyl, 4-bromophenyl, 4-bromo-2-fluorophenyl, 5-bromo-2-fluorophenyl, 3-bromo-4-fluorophenyl, 4-*tert*-butylphenyl, 2-chloro-4-fluorophenyl, 2-chloro-6-fluorophenyl, 2-chlorophenyl, 3-chlorophenyl, 4-chlorophenyl, 4-cyanophenyl, 2,3-dichlorophenyl, 2,4-dichlorophenyl, 3,4-dichlorophenyl, 2,3-dimethoxyphenyl, 3,4-dimethoxyphenyl, 2,4-dimethylphenyl, 2,5-dimethylphenyl, 2-fluorophenyl, 3-fluorophenyl, 4-fluorophenyl, 4-hexylphenyl, 3-hydroxyphenyl, 2-methoxyphenyl, 2-methylphenyl, 3-methylphenyl, 4-methylphenyl, 4-nitrophenyl, 3-phenoxyphenyl, 4-(1-pyrrolidino)phenyl, 2-(trifluoromethyl)phenyl, 3-(trifluoromethyl)phenyl, 4-(trifluoromethyl)phenyl, 3,4,5-trimethoxyphenyl, 3-(4-chlorophenoxy)phenyl or 4-acetoxy-3-methoxyphenyl.

**[0009]** Where R<sup>3</sup> is a substituted 1-naphthyl group, it is preferably 4-dimethylaminonaphthyl, 2-ethoxynaphthyl or 4-methoxynaphthyl.

**[0010]** Where R<sup>3</sup> is a substituted pyrrole group, it is preferably 2-(1-(phenylsulfonyl)-pyrrole), 2-(N-methylpyrrole), 2-(N-(3,5-dichlorophenyl)-pyrrole or 2-(1-(4-chlorophenyl)pyrrole).

**[0011]** Where R<sup>3</sup> is a substituted furfuryl group, it is preferably 2-(5-acetoxyethylfurfuryl), 2-(5-methylfurfuryl), 2-(5-nitrofurfuryl), 2-[5-(3-nitrophenyl)furfuryl], 2-[5-(2-nitrophenyl)furfuryl], 2-(5-bromofurfuryl), 2-[5-(4-chlorophenyl)furfuryl], 2-(4,5-dimethylfurfuryl), 2-[5-(2-chlorophenyl)furfuryl], 2-(5-ethylfurfuryl) or 2-[5-(1,3-dioxolane)furfuryl].

**[0012]** Where R<sup>3</sup> is a substituted thiophene group, it is preferably 2-(5-chlorothiophenyl), 2-(5-methylthiophenyl), 2-(5-ethylthiophenyl), 2-(3-methylthiophenyl), 2-(4-bromothiophenyl), 2-(5-nitrothiophenyl), 5-(2-carboxythiophenyl), 2-[4-(phenylethyl)thiophenyl], 2-[5-(methylthio)thiophenyl], 2-(3-bromothiophenyl), 2-(3-phenoxythiophenyl) or 2-(5-bromothiophenyl).

**[0013]** Where R<sup>b</sup> is a substituted phenyl group, it is preferably 3,5-bis(trifluoromethyl)phenyl, 2-bromophenyl, 2-fluorophenyl, pentafluorophenyl, 2,4-difluorophenyl, 2,6-difluorophenyl, 2-chlorophenyl, 2,4-dichlorophenyl, 2-acetylphenyl, 2-methoxyphenyl, 2,6-dimethoxyphenyl, 2-(trifluoromethyl)phenyl, 2-methylphenyl, 3-bromophenyl, 3-fluorophenyl, 3-chlorophenyl, 3,4-dichlorophenyl, 3-methoxyphenyl, 3,4-dimethoxyphenyl, 3,4,5-trimethoxyphenyl, 3,5-dimethoxyphenyl, 3-(trifluoromethyl)phenyl, 3-methoxyphenyl, 4-bromophenyl, 4-fluorophenyl, 4-chlorophenyl, 4-methoxyphenyl, 4-(trifluoromethyl)phenyl, 4-*tert*-butylphenyl, 4-methylphenyl, 2-iodophenyl, 4-iodophenyl, 4-cyanophenyl, 2-nitrophenyl, 3-nitrophenyl, 3,5-dinitrophenyl, 4-nitrophenyl, 3,5-dichlorophenyl, 2,5-difluorophenyl, 2,4-dimethoxyphenyl, 3-nitro-4-methylphenyl, 2,5-dichlorophenyl, 2,3-difluorophenyl, 4-(trifluoromethoxy)phenyl, 2-(trifluoromethoxy)phenyl or 3-(trifluoromethoxy)phenyl.

**[0014]** Where  $R^c$  is a substituted phenyl group, it is preferably 2-fluorophenyl, 2-chlorophenyl, 2-methylphenyl, 2-(trifluoromethyl)phenyl, 2-bromophenyl, 3-methoxyphenyl, 3-nitrophenyl, 3-chlorophenyl, 3-fluorophenyl, 3-phenoxyphenyl, 3-(trifluoromethoxy)phenyl, 3-bromophenyl, 3-chlorophenyl, 3-methylphenyl, 4-*tert*-butylphenyl, 4-fluorophenyl, 4-chlorophenyl, 4-vinylphenyl, 4-(trifluoromethoxy)phenyl, 3,5-dimethoxyphenyl, 3,5-difluorophenyl, 3,5-di(trifluoromethyl)phenyl, 3,5-difluorophenyl, 3,5-dimethylphenyl 2,3-dichlorophenyl, 2,3-dimethylphenyl, 2,3-difluorophenyl, 3-chloro-2-fluorophenyl, 2-chloro-4-fluorophenyl, 2,4-di(trifluoromethyl)phenyl, 2,4-dichlorophenyl, 2,4-difluorophenyl, 2,4-dimethylphenyl, 2,5-dichlorophenyl, 2,5-dimethylphenyl, 2,5-difluorophenyl, 3,4-dichlorophenyl, 3,4-difluorophenyl, 3,4-dimethylphenyl, 2,3,4-trifluorophenyl, 2,3,6-trifluorophenyl, 2,4,5-trifluorophenyl, 2,4,6-trimethylphenyl or pentafluorophenyl.

**[0015]** Where  $R^d$  is a substituted phenyl group, it is preferably 3-chlorophenyl, 4-chlorophenyl, 4-carboxyphenyl, 4-acetylphenyl, 4-methoxyphenyl, 4-fluorophenyl, 4-nitrophenyl or 4-hydroxyphenyl.

**[0016]** Bicyclic imidazo-5-yl-amines which are particularly preferred according to the invention are *tert*-butyl-(5-furan-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-furan-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

(5-*tert*-butylamino-6-furan-2-yl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

*tert*-butyl-(5-pyridin-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

*tert*-butyl-(5-pyridin-3-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(5-pyridin-4-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-cyclohexyl-imidazo[2,1-b]thiazol-5-yl)-amine,

*tert*-butyl-(5-methyl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-methyl-imidazo[2,1-b]thiazol-5-yl)-amine,

cyclohexyl-(5-pyridin-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

cyclohexyl-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

(5-cyclohexylamino-6-pyridin-2-yl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

cyclohexyl-(6-pyridin-4-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

cyclohexyl-(6-cyclohexyl-imidazo[2,1-b]thiazol-5-yl)-amine,

(6-cyclohexyl-5-cyclohexylamino-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

(5-cyclohexylamino-6-methyl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

(2,6-dimethyl-phenyl)-(5-furan-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

(2,6-dimethyl-phenyl)-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

(2,6-dimethyl-phenyl)-(6-pyridin-3-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

(2,6-dimethyl-phenyl)-(6-pyridin-4-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

methyl (6-cyclohexyl-imidazo[2,1-b]thiazol-5-ylamino)-acetate,

methyl (6-methyl-imidazo[2,1-b]thiazol-5-ylamino)-acetate,

*tert*-butyl-(2-phenyl-5H-imidazo[1,2-b]pyrazol-3-yl)-amine,

3-(5-*tert*-butylamino-imidazo[2,1-b]thiazol-6-yl)-phenol,

*tert*-butyl-[6-(3,4-dimethoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

*tert*-butyl-[5-(2,3-dichloro-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,

*tert*-butyl-[6-(2,3-dichloro-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

*tert*-butyl-[5-(2,4-dichloro-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,

*tert*-butyl-[6-(2,4-dichloro-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

*tert*-butyl-[5-(2-methoxy-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,

*tert*-butyl-[6-(2-methoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

[5-*tert*-butylamino-6-(2-methoxy-phenyl)-imidazo[2,1-b]thiazol-3-yl]-acetic acid,

*tert*-butyl-(5-o-tolyl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-o-tolyl-imidazo[2,1-b]thiazol-5-yl)-amine,

*tert*-butyl-[5-(2,3-dimethoxy-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,

*tert*-butyl-[6-(2,3-dimethoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

*tert*-butyl-(6-p-tolyl-imidazo[2,1-b]thiazol-5-yl)-amine,

(5-*tert*-butylamino-6-methyl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

N-*tert*-butyl-N-(6-phenyl-imidazo[2,1-b]thiazol-5-yl)-acetamide,

N-*tert*-butyl-N-(6-o-tolyl-imidazo[2,1-b]thiazol-5-yl)-acetamide,

butyl-[6-(4-*tert*-butyl-phenyl)-2-methyl-imidazo[2,1-b]thiazol-5-yl]amine,

*tert*-butyl-[5-(2-fluorophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,

*tert*-butyl-[6-(2-fluorophenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

*tert*-butyl-(5-naphthalen-1-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

cyclohexyl-(5-naphthalen-1-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

[5-(2-bromophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethyl-butyl)-amine,

N-[4-(6-cyclohexylamino-imidazo[1,2-b][1,2,4]triazol-5-yl)-phenyl]-acetamide,

*tert*-butyl-[5-(2,5-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,

cyclohexyl-[6-(2,4-dimethyl-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

cyclohexyl-[6-(2,5-dimethylphenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,

N-*tert*-butyl-N-(6-p-tolyl-imidazo[2,1-b]thiazol-5-yl)-acetamide,

[5-(2,4-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethyl-butyl)-amine,

[5-(2,5-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethyl-butyl)-amine,

N-butyl-N-[5-(2-chloro-6-fluorophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-acetamide or

N-butyl-N-[6-(4-*tert*-butyl-phenyl)-2-methyl-imidazo[2,1-b]thiazol-5-yl]-acetamide.

**[0017]** If the bicyclic imidazo-5-yl-amines according to the invention contain optically active carbon atoms, the present invention also provides the enantiomers of these compounds and mixtures thereof. The present invention also provides pharmaceutically acceptable salts thereof.

**[0018]** The invention furthermore provides medicaments or pharmaceutical compositions comprising as the active compound at least one bicyclic imidazo-5-yl-amine of the general formula I, in which R<sup>1</sup> to R<sup>6</sup>, X and Y have the abovementioned meaning, in the form of the base or of pharmaceutically acceptable salts, preferably of hydrobromic acid, sulfuric acid, methanesulfonic acid, formic acid, acetic acid, oxalic acid, succinic acid, tartaric acid, mandelic acid, fumaric acid, lactic acid, citric acid, glutamic acid and/or aspartic acid, or in particular of hydrochloric acid.

**[0019]** The medicaments according to the invention particularly preferably comprise as the active compound at least one bicyclic imidazo-5-yl-amine chosen from the group consisting of

*tert*-butyl-(5-furan-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-furan-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

(5-*tert*-butylamino-6-furan-2-yl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

*tert*-butyl-(5-pyridin-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

*tert*-butyl-(5-pyridin-3-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(5-pyridin-4-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-cyclohexyl-imidazo[2,1-b]thiazol-5-yl)-amine,

*tert*-butyl-(5-methyl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

*tert*-butyl-(6-methyl-imidazo[2,1-b]thiazol-5-yl)-amine,

cyclohexyl-(5-pyridin-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

cyclohexyl-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

(5-cyclohexylamino-6-pyridin-2-yl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

cyclohexyl-(6-pyridin-4-yl-imidazo[2,1-b]thiazol-5-yl)-amine,

cyclohexyl-(6-cyclohexyl-imidazo[2,1-b]thiazol-5-yl)-amine,

(6-cyclohexyl-5-cyclohexylamino-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

(5-cyclohexylamino-6-methyl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,

(2,6-dimethyl-phenyl)-(5-furan-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,

(2,6-dimethyl-phenyl)-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine,  
(2,6-dimethyl-phenyl)-(6-pyridin-3-yl-imidazo[2,1-b]thiazol-5-yl)-amine,  
(2,6-dimethyl-phenyl)-(6-pyridin-4-yl-imidazo[2,1-b]thiazol-5-yl)-amine,  
methyl (6-cyclohexyl-imidazo[2,1-b]thiazol-5-ylamino)-acetate,  
methyl (6-methyl-imidazo[2,1-b]thiazol-5-ylamino)-acetate,  
*tert*-butyl-(2-phenyl-5H-imidazo[1,2-b]pyrazol-3-yl)-amine,  
3-(5-*tert*-butylamino-imidazo[2,1-b]thiazol-6-yl)-phenol,  
*tert*-butyl-[6-(3,4-dimethoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
*tert*-butyl-[5-(2,3-dichloro-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,  
*tert*-butyl-[6-(2,3-dichloro-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
*tert*-butyl-[5-(2,4-dichloro-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,  
*tert*-butyl-[6-(2,4-dichloro-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
*tert*-butyl-[5-(2-methoxy-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,  
*tert*-butyl-[6-(2-methoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
[5-*tert*-butylamino-6-(2-methoxy-phenyl)-imidazo[2,1-b]thiazol-3-yl]-acetic acid,  
*tert*-butyl-(5-o-tolyl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,  
*tert*-butyl-(6-o-tolyl-imidazo[2,1-b]thiazol-5-yl)-amine,  
*tert*-butyl-[5-(2,3-dimethoxy-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,  
*tert*-butyl-[6-(2,3-dimethoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
*tert*-butyl-(6-p-tolyl-imidazo[2,1-b]thiazol-5-yl)-amine,

(5-*tert*-butylamino-6-methyl-imidazo[2,1-b]thiazol-3-yl)-acetic acid,  
N-*tert*-butyl-N-(6-phenyl-imidazo[2,1-b]thiazol-5-yl)-acetamide,  
N-*tert*-butyl-N-(6-o-tolyl-imidazo[2,1-b]thiazol-5-yl)-acetamide,  
butyl-[6-(4-*tert*-butyl-phenyl)-2-methyl-imidazo[2,1-b]thiazol-5-yl]amine,  
*tert*-butyl-[5-(2-fluorophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,  
*tert*-butyl-[6-(2-fluorophenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
*tert*-butyl-(5-naphthalen-1-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,  
cyclohexyl-(5-naphthalen-1-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine,  
[5-(2-bromophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethyl-butyl)-amine,  
N-[4-(6-cyclohexylamino-imidazo[1,2-b][1,2,4]triazol-5-yl)-phenyl]-acetamide,  
*tert*-butyl-[5-(2,5-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine,  
cyclohexyl-[6-(2,4-dimethyl-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
cyclohexyl-[6-(2,5-dimethylphenyl)-imidazo[2,1-b]thiazol-5-yl]-amine,  
N-*tert*-butyl-N-(6-p-tolyl-imidazo[2,1-b]thiazol-5-yl)-acetamide,  
[5-(2,4-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethyl-butyl)-amine,  
[5-(2,5-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethyl-butyl)-amine,  
N-butyl-N-[5-(2-chloro-6-fluorophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-acetamide and

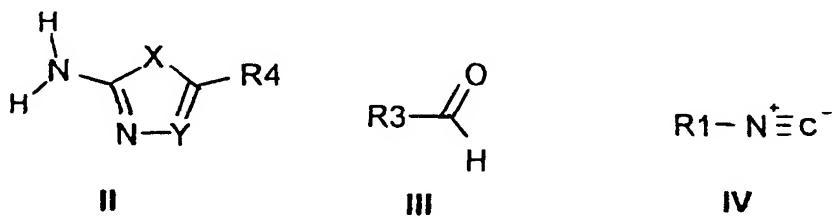
N-butyl-N-[6-(4-*tert*-butyl-phenyl)-2-methyl-imidazo[2,1-b]thiazol-5-yl]-acetamide, in the form of the base or of pharmaceutically acceptable salts.

**[0020]** The compounds according to the invention are ligands of the pain-relevant  $\alpha$ 2-subtype of the human  $\alpha$ -adrenergic receptor. The use of the bicyclic imidazo-5-yl-amines according to the invention together with one or more auxiliary substances for the preparation of a medicament for combating pain, or method for treating pain comprising administering a pharmaceutically acceptable effective amount of the bicyclic imidazo-5-yl-amines to a patient in need thereof, is therefore particularly preferred.

**[0021]** For the preparation of appropriate medicaments, in addition to at least one active compound according to the invention, carrier materials, fillers, solvents, diluents, dyestuffs, binders and/or other pharmaceutically acceptable excipients are employed. The choice of auxiliary substances and the amounts thereof to be employed depend on whether the medicament is to be administered orally, intravenously, intraperitoneally, intradermally, intramuscularly, intranasally, buccally or locally. Formulations in the form of tablets, coated tablets, capsules, granules, drops, juices and syrups are suitable for oral administration, and solutions, suspensions, easily reconstitutable dry formulations and sprays are suitable for parenteral, topical and inhalatory administration. Active compounds according to the invention in a depot, in dissolved form or in a patch, optionally with the addition of agents which promote penetration through the skin, are suitable formulations for percutaneous administration. Formulation forms which can be used orally or percutaneously can release the active compounds according to the invention in a retarded manner.

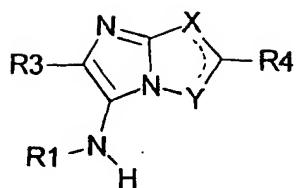
**[0022]** The amount of active compound to be administered to the patient varies according to the body weight of the patient, and to the mode of administration, the indication and the severity of the disease.

[0023] The compounds according to the invention are synthesized by a procedure in which an amidine with the general formula **II**, in particular 3-aminopyrazole, 3-amino-1,2,4-triazole, 2-amino, 1,3,4-thiadiazole or a 2-aminothiazole derivative, which are commercially available from companies such as Acros, Avocado, Aldrich, Fluka, Lancaster, Maybridge, Merck, Sigma or TCI-Jp, are reacted with the most diverse aldehydes **III** and isonitriles **IV** in the presence of 20% perchloric acid in accordance with a three-component reaction to form a compound of the formula **Ia** (see below). R1 to R3, X and Y here have the meaning given above for compounds of the formula **I**.



[0024] The reactions are preferably carried out in methylene chloride (MC) at a temperature of 0°C to 40°C, in particular at 10°C to 20°C.

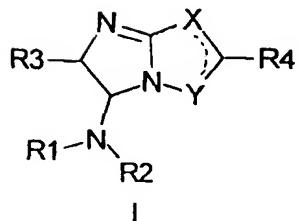
[0025] To prepare the compounds according to the invention in which R<sup>2</sup> does not denote hydrogen, the compounds **Ia** formed in the reaction described above, which have preferably first been dissolved in methylene chloride or THF (5-hydroxymethylene tetrahydrofolate, or tetrahydrofuran), are reacted, depending on the desired end product, with a compound R<sup>2</sup>Hal, wherein Hal represents bromine, iodine or, in particular, chlorine, for example an optionally substituted alkyl, aryl or acid chloride, or an optionally substituted isocyanate R<sup>e</sup>NCO in the presence of a morpholine resin (e.g. polystyrene-morpholine from Argonaut) in methylene chloride in the course of 2 to 24 hours at temperatures between 10°C and 40°C in accordance with the following equation:



Ia

1.)  $R^2\text{Hal}$  or  $R^e\text{NCO}$ polymer-bonded morpholine; MC,  $T = 10-40^\circ\text{C}$ , 2-24h

2.) polymer-bonded tris(2-aminoethyl)amine



**[0026]** The excess reagents are then removed from the reaction mixture by

filtration over a layer with polymer-bonded tris(2-aminoethyl)amine

(manufacturer: Novabiochem) or 3-(3-

mercaptophenyl)propanamidomethylpolystyrene and the filtrate is preferably concentrated in a vacuum centrifuge. The entire process can also easily be carried out in an automated synthesis unit.

**[0027]** The compounds of the formula I can be converted into their

pharmaceutically acceptable salts in a manner well-known to those ordinarily skilled in the art with physiologically tolerated acids, preferably hydrobromic acid, sulfuric acid, methanesulfonic acid, formic acid, acetic acid, oxalic acid,

succinic acid, tartaric acid, mandelic acid, fumaric acid, lactic acid, citric acid, glutamic acid and/or aspartic acid, and in particular hydrochloric acid. The salt formation is preferably carried out in a solvent, in particular diethyl ether,

diisopropyl ether, acetic acid alkyl esters, acetone or 2-butanone, or a mixture of

these solvents. Alternatively, trimethylsilane in aqueous solution is also suitable for preparation of the hydrochlorides.

**Examples:**

**[0028]** The following examples are intended to illustrate the invention without limiting it thereto.

**[0029]** The synthesis of the compounds was carried out in an automatic unit from Zymark in accordance with the following general synthesis instructions:

**[0030]** A round-bottomed tube of glass (diameter 16 mm, length 125 mm) with a thread was provided manually with a stirrer and closed with a screw-cap with a septum on the capper station. The tube was placed by robot 1 in the reactor block temperature-controlled at 15°C. Robot 2 pipetted in the following reagents in succession:

1.) 1 ml of a 0.1 M amidine solution + 20% HClO<sub>4</sub> in methylene chloride

2.) 0.5 ml of a 0.3 M aldehyde solution in methylene chloride

3.) 0.575 ml of a 0.2 M isonitrile solution in methylene chloride

**[0031]** The reaction mixture was stirred at 15°C in one of the stirring blocks for 660 min. Thereafter, the reaction solution was filtered at the filtration station. The tube was rinsed here twice with in each case 1 ml methylene chloride and 200 µl water.

**[0032]** The rack with the tubes was then placed manually on the working-up unit. On this, 3 ml of a 10% NaCl solution and 1.5 ml methylene chloride were added to the reaction mixture on a vortexer. The components were mixed thoroughly in the spin reactor for ten minutes and a clear phase boundary was formed by slowly decreasing the rotational movement. This phase boundary was detected optically and the organic phase was pipetted off. In the next step, 1.5 ml methylene chloride were again added to the reaction mixture. The solution

was shaken and centrifuged and the organic phase was pipetted off. The combined organic phases were dried over 2.4 g MgSO<sub>4</sub> (granulated). The solvent was removed in a vacuum centrifuge.

**[0033]** For the examples in which the compound formed in this way was reacted further with acetyl chloride, this was effected in accordance with the following general instructions:

**[0034]** The product obtained in accordance with the above general synthesis instructions was dissolved in methylene chloride, 4 molar equivalents of acetyl chloride were added and the mixture was stirred at 18°C for four hours. The excess acetyl chloride and the solvent were removed at 40-60°C in vacuo.

**[0035]** The chemicals and solvents employed were obtained commercially. Each substance was analysed by ESI-MS and/or NMR.

**[0036] Example 1**

*tert*-Butyl-(5-furan-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (**1**)

Compound **1** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) furfural solution (0.3 M, MC) and 10 µl perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 262

**[0037] Example 2**

*tert*-Butyl-(6-furan-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine (**2**)

Compound **2** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115

mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) furfural solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 262

**[0038] Example 3**

*(5-tert-Butylamino-6-furan-2-yl-imidazo[2,1-b]thiazol-3-yl)-acetic acid (3)*

Compound 3 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) (2-aminothiazol-4-yl)acetic acid solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) furfural solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 320

**[0039] Example 4**

*tert-Butyl-(5-pyridin-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (4)*

Compound 4 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 257

**[0040] Example 5*****tert*-Butyl-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine (5)**

Compound 5 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 273

**[0041] Example 6*****tert*-Butyl-(5-pyridin-3-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (6)**

Compound 6 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 3-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 257

**[0042] Example 7*****tert*-Butyl-(5-pyridin-4-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)amine (7)**

Compound 7 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 4-

pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 257

**[0043] Example 8**

*tert*-Butyl-(6-cyclohexyl-imidazo[2,1-b]thiazol-5-yl)- amine (8)

Compound 8 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) cyclohexylcarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 278

**[0044] Example 9**

*tert*-Butyl-(5-methyl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (9)

Compound 9 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) acetaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 194

**[0045] Example 10*****tert*-Butyl-(6-methyl-imidazo[2,1-b]thiazol-5-yl)-amine (10)**

Compound **10** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) aldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 210

**[0046] Example 11****Cyclohexyl-(5-pyridin-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (11)**

Compound **11** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 283

**[0047] Example 12****Cyclohexyl-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine (12)**

Compound **12** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol)

2-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 299

**[0048] Example 13**

(5-Cyclohexylamino-6-pyridin-2-yl-imidazo[2,1-b]thiazol-3-yl)-acetic acid (**13**)

Compound **13** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) (2-aminothiazol-4-yl)acetic acid solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 3-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 357

**[0049] Example 14**

Cyclohexyl-(6-pyridin-4-yl-imidazo[2,1-b]thiazol-5-yl)-amine (**14**)

Compound **14** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 3-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 299

**[0050] Example 15**

**Cyclohexyl-(6-cyclohexyl-imidazo[2,1-b]thiazol-5-yl)- amine (15)**

Compound **15** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) cyclohexylcarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 304

**[0051] Example 16**

**(6-Cyclohexyl-5-cyclohexylamino-imidazo[2,1-b]thiazol-3-yl)-acetic acid (16)**

Compound **16** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) (2-aminothiazol-4-yl)acetic acid solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) cyclohexylcarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 318

**[0052] Example 17**

**(5-Cyclohexylamino-6-methyl-imidazo[2,1-b]thiazol-3-yl)-acetic acid (17)**

Compound **17** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) (2-aminothiazol-4-yl)acetic acid solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500

ml (0.15 mmol) acetaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 250

**[0053] Example 18**

**(2,6-Dimethyl-phenyl)-(5-furan-2-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (18)**

Compound **18** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) 2,6-dimethylphenylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) furfural solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 292

**[0054] Example 19**

**(2,6-Dimethyl-phenyl)-(6-pyridin-2-yl-imidazo[2,1-b]thiazol-5-yl)-amine (19)**

Compound **19** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) 2,6-dimethylphenylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 321

**[0055] Example 20**

(2,6-dimethyl-phenyl)-(6-pyridin-3-yl-imidazo[2,1-b]thiazol-5-yl)-amine (**20**)

Compound **20** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) 2,6-dimethylphenylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 3-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 321

**[0056] Example 21**

(2,6-Dimethyl-phenyl)-(6-pyridin-4-yl-imidazo[2,1-b]thiazol-5-yl)-amine (**21**)

Compound **21** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) 2,6-dimethylphenylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 4-pyridinecarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 321

**[0057] Example 22**

Methyl (6-cyclohexyl-imidazo[2,1-b]thiazol-5-ylamino)-acetate (**22**)

Compound **22** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) methyl isocyanoacetate solution (0.2 M, MC), 0.500 ml

(0.15 mmol) cyclohexylcarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 294

**[0058] Example 23**

Methyl (6-methyl-imidazo[2,1-b]thiazol-5-ylamino)- acetate (**23**)

Compound **23** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) methyl isocyanoacetate solution (0.2 M, MC), 0.500 ml (0.15 mmol) acetaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 226

**[0059] Example 24**

*tert*-Butyl-(2-phenyl-5H-imidazo[1,2-b]pyrazol-3-yl)- amine (**24**)

Compound **24** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-pyrazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) benzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 255

**[0060] Example 25**

3-(5-*tert*-Butylamino-imidazo[2,1-b]thiazol-6-yl)- phenol (25)

Compound 25 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 3-hydroxybenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 288

**[0061] Example 26**

*tert*-Butyl-[6-(3,4-dimethoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine (26)

Compound 26 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 3,4-dimethoxybenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 332

**[0062] Example 27**

*tert*-Butyl-[5-(2,3-dichloro-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine (27)

Compound 27 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml

(0.15 mmol) 2,3-dichlorobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 324

**[0063] Example 28**

*tert*-Butyl-[6-(2,3-dichloro-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine (**28**)

Compound **28** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,3-dichlorobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 340

**[0064] Example 29**

*tert*-Butyl-[5-(2,4-dichloro-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine (**29**)

Compound **29** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,4-dichlorobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 324

**[0065] Example 30**

*tert*-Butyl-[6-(2,4-dichloro-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine (**30**)

Compound **30** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,4-dichlorobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 340

**[0066] Example 31**

*tert*-Butyl-[5-(2-methoxy-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine (**31**)

Compound **31** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-methoxybenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 286

**[0067] Example 32**

*tert*-Butyl-[6-(2-methoxy-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine (**32**)

Compound **32** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-

methoxybenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 302

**[0068] Example 33**

[5-*tert*-Butylamino-6-(2-methoxy-phenyl)-imidazo[2,1-b]thiazol-3-yl]-acetic acid (33)

Compound 33 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) (2-aminothiazol-4-yl)acetic acid solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-methoxybenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 321

**[0069] Example 34**

*tert*-Butyl-(5-*o*-tolyl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (34)

Compound 34 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-methylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 270

**[0070] Example 35**

*tert*-Butyl-(6-*o*-tolyl-imidazo[2,1-*b*]thiazol-5-yl)- amine (35)

Compound 35 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-methylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 321

**[0071] Example 36**

*tert*-Butyl-[5-(2,3-dimethoxy-phenyl)-imidazo[1,2-*b*][1,2,4]triazol-6-yl]-amine (36)

Compound 36 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,3-dimethoxybenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 316

**[0072] Example 37**

*tert*-Butyl-[6-(2,3-dimethoxy-phenyl)-imidazo[2,1-*b*]thiazol-5-yl]-amine (37)

Compound 37 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol)

2,3-dimethoxybenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 332

**[0073] Example 38**

*tert*-Butyl-(6-p-tolyl-imidazo[2,1-b]thiazol-5-yl)- amine (**38**)

Compound **38** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 4-methylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 286

**[0074] Example 39**

(5-*tert*-Butylamino-6-methyl-imidazo[2,1-b]thiazol-3-yl)-acetic acid (**39**)

Compound **39** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) (2-amino-thiazol-4-yl)-acetic acid solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) acetaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: M-CO<sub>2</sub> 224.3

**[0075] Example 40****N-*tert*-Butyl-N-(6-phenyl-imidazo[2,1-b]thiazol-5-yl)-acetamide (40)**

Compound **40** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) benzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) and by reaction with acetyl chloride, the excess acetyl chloride being removed in vacuo.

An ESI-MS was recorded for characterization.

Mass found: 315.3, M-acetyl 272.1

**[0076] Example 41****N-*tert*-Butyl-N-(6-o-tolyl-imidazo[2,1-b]thiazol-5-yl)-acetamide (41)**

Compound **41** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-methylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) and by reaction with acetyl chloride, the excess acetyl chloride being removed in vacuo

An ESI-MS was recorded for characterization.

Mass found: M-acetyl 286.3

**[0077] Example 42****Butyl-[6-(4-*tert*-butyl-phenyl)-2-methyl-imidazo[2,1-b]thiazol-5-yl]-amine (42)**

Compound **42** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 5-methyl-thiazol-2-yl-amine solution (0.1 M, MC), 0.575 ml (0.115 mmol) *n*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15

mmol) 4-*tert*-butylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 342.3

**[0078] Example 43**

*tert*-Butyl-[5-(2-fluorophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine (43)

Compound 43 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-fluorobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 274.1

**[0079] Example 44**

*tert*-Butyl-[6-(2-fluorophenyl)-imidazo[2,1-b]thiazol-5-yl]-amine (44)

Compound 44 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-fluorobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 290.2

**[0080] Example 45*****tert*-Butyl-(5-naphthalen-1-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (45)**

Compound **45** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 1-naphthylcarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 306.2

**[0081] Example 46****Cyclohexyl-(5-naphthalen-1-yl-imidazo[1,2-b][1,2,4]triazol-6-yl)-amine (46)**

Compound **46** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 1-naphthylcarbaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 332.3

**[0082] Example 47****[5-(2-Bromophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethyl-butyl)-amine (47)**

Compound **47** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) 1,1,3,3-tetramethylbutylisonitrile solution (0.2 M, MC),

0.500 ml (0.15 mmol) 2-bromobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 390.3/392.2

**[0083] Example 48**

*N*-(4-(6-Cyclohexylamino-imidazo[1,2-b][1,2,4]triazol-5-yl)-phenyl)-acetamide (48)

Compound 48 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) *N*-(4-formyl-phenyl)-acetamide solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 337.1

**[0084] Example 49**

*tert*-Butyl-[5-(2,5-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-amine (49)

Compound 49 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,5-dimethylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 284.2

**[0085] Example 50****Cyclohexyl-[6-(2,4-dimethyl-phenyl)-imidazo[2,1-b]thiazol-5-yl]-amine (50)**

Compound **50** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,4-dimethylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 326.3

**[0086] Example 51****Cyclohexyl-[6-(2,5-dimethylphenyl)-imidazo[2,1-b]thiazol-5-yl]-amine (51)**

Compound **51** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) cyclohexylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,5-dimethylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) in a substance library.

An ESI-MS was recorded for characterization.

Mass found: 326.3

**[0087] Example 52****N-*tert*-Butyl-N-(6-p-tolyl-imidazo[2,1-b]thiazol-5-yl)-acetamide (52)**

Compound **52** was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-aminothiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) *tert*-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 4-methylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%)

and by reaction with acetyl chloride, the excess acetyl chloride being removed in vacuo.

An ESI-MS was recorded for characterization.

Mass found: 327.4, M-acetyl 286.3

**[0088] Example 53**

**[5-(2,4-dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethylbutyl)-amine (53)**

Compound 53 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) 1,1,3,3-tetramethylbutylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,4-dimethylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%).

An ESI-MS was recorded for characterization.

Mass found: 340.2

**[0089] Example 54**

**[5-(2,5-Dimethyl-phenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-(1,1,3,3-tetramethylbutyl)-amine (54)**

Compound 54 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) 1,1,3,3-tetramethylbutylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2,5-dimethylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%).

An ESI-MS was recorded for characterization.

Mass found: 340.2

**[0090] Example 55**

N-Butyl-N-[5-(2-chloro-6-fluorophenyl)-imidazo[1,2-b][1,2,4]triazol-6-yl]-acetamide (55)

Compound 55 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 3-amino-1,2,4-triazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) n-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 2-chloro-6-fluorobenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) and by reaction with acetyl chloride, the excess acetyl chloride being removed in vacuo.

An ESI-MS was recorded for characterization.

Mass found: 350.4

**[0091] Example 56**

N-Butyl-N-[6-(4-*tert*-butyl-phenyl)-2-methyl-imidazo[2,1-b]thiazol-5-yl]-acetamide (56)

Compound 56 was prepared in accordance with the general synthesis instructions from 1.0 ml (0.1 mmol) 2-amino-5-methylthiazole solution (0.1 M, MC), 0.575 ml (0.115 mmol) n-butylisonitrile solution (0.2 M, MC), 0.500 ml (0.15 mmol) 4-*tert*-butylbenzaldehyde solution (0.3 M, MC) and 10  $\mu$ l perchloric acid (w = 20%) and by reaction with acetyl chloride, the excess acetyl chloride being removed in vacuo.

An ESI-MS was recorded for characterization.

Mass found: 384.5

**[0092]** The compounds according to the invention are ligands of the pain-relevant  $\alpha$ 2-subtype of the human  $\alpha$ -adrenergic receptor. The affinity for the  $\alpha$ 2-subtype of the human  $\alpha$ -adrenergic receptor was determined by means of a

conventional SPA assay for high throughput screening, such as is described in John P. Devlin, High Throughput Screening, Marcel Dekker Inc. 1997, page 307 to 316. This literature is incorporated herein by reference and thus forms part of the disclosure. The following affinities were determined at a concentration of 10  $\mu$ M:

	alpha2 affinity, 10 $\mu$ M
Example 39	35%
Example 40	77%
Example 41	50%
Example 42	36%
Example 43	34%
Example 44	38%
Example 45	41%
Example 46	46%
Example 47	42%
Example 48	36%
Example 49	38%
Example 50	36%
Example 51	39%
Example 52	51%
Example 53	43%
Example 54	56%
Example 55	39%
Example 56	46%

**[0093]** The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to broadly include everything within the scope of the appended claims and equivalents thereof.